

A TECHNIQUE FOR TESTING HEART FUNCTION
BY ANALYSIS
OF ITS VIBRATION SPECTRUM

PROGRESS REPORT

31 December 1966 through 30 June 1967

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submitted by

Clarence M. Agress, M. D.
Cedars-Sinai Medical Research Institute
Room 109, 4751 Fountain Avenue
Los Angeles, California 90029

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The following report describes the accomplishments under NASA Grant #NsG 289/05-12-001 for the six month period of 31 December 1966 through 31 June 1967.

During this phase of research, our previously described method for indirectly determining stroke volume by isovolumetric contraction and ejection periods has been extended to a new series of human subjects. In this current study the vibrocardiogram was used to measure the cardiac intervals and the dye dilution technique used to measure cardiac output in 10 normal subjects and 11 patients recovering from acute myocardial infarction. The correlation between the vibrocardiographic method and the dye output was highly significant ($r = 0.90$), substantiating our previous observations. This material has been accepted for publication by Aerospace Medicine.

An analog computer model of the left heart has undergone preliminary design, in order to test the cardiac interval - stroke volume correlation on a theoretical basis. This model will simulate blood flows and pressures through the left heart and systemic circuit and will facilitate the performance of experiments in which parameters such as heart rate, arterial pressure, cardiac

output, etc., can be varied independently and their effect on the interval - stroke volume determined. This work is being performed in conjunction with the Life Science Division of North American Aviation Corporation.

In order to assess the importance of stroke volume in the estimation of cardiac function in exercise, a review of the literature has been initiated in which the cardiac output, stroke volume and heart rate are examined with reference to the subject's posture during exercise, and his physical conditioning. This study is being undertaken to gain better insight into the use of stroke volume and heart rate as determinants of cardiovascular performance and function during exertion.

In addition to these areas of research, two presentations have been made. The first was an exhibit entitled, "Indirect Measurement of Stroke Volume", and was presented at the Fourth Annual Cardiovascular Symposium for Physicians Practicing General Medicine, at the Ambassador Hotel in Los Angeles, California on March 29, 1967. The second was a paper entitled,

"Use of the Vibrocardiogram as a Cardiovascular Monitor", and was presented at the Aerospace Medical Association Meeting in Washington, D. C., in April, 1967. An abstract of this paper, which summarizes the hemodynamic measurements which are obtainable from the vibrocardiogram, is enclosed. The paper, entitled, "Signal Averaging Techniques for Chest Wall Vibration Recording", which was described in an earlier report, has now been published in Medical Research Engineering, First Quarter, 1967:20-22, and copies will be forwarded when they become available.